

PS00007355A05

GR20-16EMNL

Digital Input and Output Module

User Guide

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Preface

■ Introduction

The GR20-16EMNL is a transistor NPN module with 16 configurable digital inputs and outputs. Each of the 16 channels can be configured as either a sink-type input or output. The module can be used together with the Class A IO-Link master.

This guide describes the mechanical installation, electrical installation, configuration, commissioning, troubleshooting, and object list of the product.

■ Standard

The following table lists the certifications, directives, and standards that the product may comply with. For details about the acquired certificates, see the certification marks on the product nameplate.

Certification	Directive		Standard
CE Certification	EMC Directive	2014/30/EU	24 VDC products: EN 61131-2 220 VAC products: EN 61131-2 EN 61000-3-2 EN 61000-3-3
	LVD Directive	2014/35/EU	EN 61010-1 EN 61010-2-201
	RoHS Directive	2011/65/EU amended by (EU) 2015/863	EN IEC 63000
UL/cUL Certification	-		UL 61010-1 UL 61010-2-201 CAN/CSA-C22.2 No. 61010-1 CSA C22.2 NO. 61010-2-201
KCC Certification	-		-

Certification	Directive		Standard
EAC Certification	-		-
UKCA Certification	Safety Regulations	Electrical Equipment (Safety) Regulations 2016	EN 61010-1 EN 61010-2-201
	EMC Regulations	Electromagnetic Compatibility Regulations 2016	24 VDC products: EN 61131-2 220 VAC products: EN 61131-2 EN 61000-3-2 EN 61000-3-3
	RoHS Regulations	Directive (RoHS) Regulations 2012	EN IEC 63000

More Documents

Document Name	Document Coding	Description
GS20-ECT-8L High Protection IO-Link Master Module User Manual	PS00007354	This guide describes the product information, mechanical installation, electrical installation, configuration, commissioning, and troubleshooting of the product.
GR20-16EMNL Digital Input and Output Module User Guide (This guide)	PS00007355	This guide describes the mechanical installation, electrical installation, configuration, commissioning, and troubleshooting of the product.

■ Revision History

Revision date	Version	Description
December 2024	A05	Added the following content: Added "Appendix: Version Matching Information" on page 38. Updated the following content: - Updated "Software specifications" in "1.3 Technical Specifications" on page 13. - Updated "Fault Diagnosis" on page 31. - Updated "0x49: Mode Configuration (R/W)" in "6.3 Product Data" on page 33.
August 2024	A04	Added the following content: Added "2.1 Installation Precautions" on page 18. Updated the following content: Updated "Undervoltage detection" in "1.3 Technical Specifications" on page 13.
November 2023	A03	Made minor corrections.
September 2023	A02	Updated the following content: - Added the fault code "0x7710" in "Fault Diagnosis" on page 31. - Updated the index "0x42" and added the index "0x43" in "6.3 Product Data" on page 33.
January 2023	A01	Added "Environmental Specifications". Made minor corrections.
November 2022	A00	Initial release.

■ Access to the Guide

This guide is not delivered with the product. You can obtain the PDF version by the following methods:

- Do keyword search under Service and Support at www.inovance.com.
- Scan the QR code on the product with your smart phone.
- Scan the QR code below to install My Inovance app, where you can search for and download user guides.



■ Warranty Disclaimer

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is not caused by improper operation of the user. Maintenance will be charged after the warranty expires.

Within the warranty period, maintenance will be charged for the following damage:

- Damage caused by operations not following the instructions in the user guide
- Damage caused by fire, flood, or unusual voltage
- Damage caused by unintended use of the product
- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

The maintenance is charged according to the latest Price List of Inovance. If otherwise agreed upon, the terms and conditions in the agreement shall prevail.

For details, see the Product Warranty Card.

Fundamental Safety Instructions

■ Safety Disclaimer

1. Read through the safety instructions before installing, operating, and servicing the equipment, and comply with these instructions.
2. To ensure personal and equipment safety, observe the notes indicated on the product labels and all the safety instructions in the user guide.
3. "CAUTION", "WARNING", and "DANGER" in this guide only indicate some of the precautions that need to be followed; they just supplement the safety precautions.
4. Use this product in environments meeting the design and specification requirements; otherwise, a fault may occur. Noncompliance-caused malfunction or damage to parts are not covered in product quality warranty.
5. Inovance shall take no responsibility for any personal injury or property damage caused by improper use.

■ Safety Levels and Definitions



"DANGER" indicates that failure to comply with the notice will result in death or severe personal injuries.



"WARNING" indicates that failure to comply with the notice may result in death or severe personal injuries.



"CAUTION" indicates that failure to comply with the notice may result in minor or moderate personal injury or equipment damage. Keep this user guide properly for future use and deliver it to the end user.

Control System Design



DANGER

- Provide a safety circuit outside the PLC so that the control system can still work safely once external power failure or controller fault occurs.
- Add a fuse or circuit breaker because the module may smoke or catch fire due to long-time overcurrent caused by operation above rated current or load short-circuit.



WARNING

- An emergency stop circuit, a protection circuit, a forward/reverse operation interlocked circuit, and an upper position limit and lower position limit interlocked circuit must be set in the external circuits of PLC to prevent damage to the machine.
- To ensure safe operation, for the output signals that may cause critical accidents, use external protection circuits and safety mechanism.
- Once PLC CPU detects abnormality in the system, all outputs may be closed; however, when a fault occurs in the controller circuit, the output may not be under control. Therefore, it is necessary to design an appropriate external control circuit to ensure normal operation.
- If the PLC output units such as relays or transistors are damaged, the output may fail to switch between ON and OFF states according to the commands.
- The PLC is designed to be used in an indoor electrical environment (overvoltage category II). The power supply must have a system-level surge protector, assuring that overvoltage due to lightning shock can't be applied to the PLC's power supply input terminals, signal input terminals and output terminals, to prevent damage to the equipment.

Installation



- Installation must be carried out by skilled personnel who have undergone specialized electrical training and possess comprehensive electrical expertise.
- Disconnect all external power supplies of the system before removing/installing the module. Failure to do so may result in electric shock, module fault or malfunction.
- Do not use the PLC in environments with dust, greasy smoke, conductive dust, corrosive or combustible gases, exposed to high temperature, condensation, wind & rain, or subject to vibration and shock. Electric shock, fire and malfunction may also result in damage or deterioration to the product.
- The PLC is open-type equipment that must be installed in a control cabinet with lock (cabinet housing protection > IP20). Only the skilled personnel who have undergone specialized electrical training and possess comprehensive electrical expertise can open the cabinet.



- Prevent metal filings and wire ends from dropping into ventilation holes of the PLC during installation. Failure to comply may result in fire, fault and malfunction.
- Ensure there are no foreign matters on ventilation surface. Failure to comply may result in poor ventilation, which may cause fire, fault and malfunction.
- Ensure the module is connected to the respective connector securely and hook the module firmly. Improper installation may result in malfunction, fault or fall-off.

Wiring



- Wiring must be carried out by skilled personnel who have undergone specialized electrical training and possess comprehensive electrical expertise.
- Disconnect all external power supplies of the system before wiring. Failure to comply may result in electric shock, module fault or malfunction.
- Install the terminal cover attached to the product before power-on or operation after wiring is done. Failure to comply may result in electric shock.
- Insulate the cable terminals properly to ensure the insulation distance between cables will not be shortened after cables are connected to the terminal block. Failure to comply may result in electric shock or damage to the equipment.

Wiring



- To avoid electric shock, cut off the power supply before connecting the product to the power supply.
- The input power supply of this product must be 24 VDC. Power supplies outside $\pm 20\%$ of 24 VDC can cause severe damage to the product. Therefore, check whether the DC power supply provided by the switching-mode power supply is stable at a regular interval.

Operation and Maintenance



- Operation and maintenance must be carried out by skilled personnel who have undergone specialized electrical training and possess comprehensive electrical expertise.
- Do not touch the terminals while the power is on. Failure to comply may result in electric shock or malfunction.
- Disconnect all external power supplies of the system before cleaning the module or re-tightening screws on the terminal block or screws of the connector. Failure to comply may result in electric shock.
- Disconnect all external power supplies of the system before assembling/disassembling the module or connecting/removing the communication cables. Failure to comply may result in electric shock or malfunction.

Safety Recommendations

- In the position where the operator directly touches the machinery part, for example, where a machinery tool is loaded/unloaded, or where a machine runs automatically, the on-site manual operating devices and any other alternative means must be carefully arranged and designed so that they are independent of the programmable controller and can start or terminate the automatic running of the system.
- If modification on the program is needed during system operation, use the lock function or other protective measures. Ensure that only authorized personnel can make the necessary modifications.

Disposal



CAUTION

- Treat the scrapped product as industrial waste. Dispose of the battery according to local laws and regulations.
- Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

1 Product Information

1.1 Naming Rules and Nameplate

G R 20 - 16 E M N L

① ② ③ ④ ⑤ ⑥ ⑦

① Product Family G: Inovance controller general-purpose module	⑤ Module Type E: Logic I/O expansion module
② Product Type R: Remote module	⑥ I/O type MN: Each channel can be configured as either a NPN input or output.
③ Series 20: 20 series	⑦ Connection type L: IO-Link
④ Number of I/O Channels 16: 16 channels	-



The order data of the product is described in the following table.

Model	Description	Product Code	Applicable model
GR20-16EMNL	GR20 series transistor NPN module with configurable 16 digital outputs and inputs	01440355	Class A IO-Link master

1.2 Components



No.	Name	Description			
①	Status indicator	US	System power supply indicator	Green	- Steady on: US power supply normal - Single flashing: $11\text{ V} < \text{US voltage} < 18\text{ V}$ - Flashing: US voltage $> 30.2\text{ V}$ - Off: no power supply
		UA	Actuator power supply indicator	Green	- Steady on: UA power supply normal - Single flashing: $11\text{ V} < \text{UA voltage} < 18\text{ V}$ - Flashing: UA voltage $> 30.2\text{ V}$ - Off: no power supply
		COM	IO-Link communication indicator	Green/red	- Steady green: no communication - Slow flashing green: IO-Link communication normal - Slow flashing red: diagnostic information present in module - Off: no voltage present in module
②	IO-Link port	Designed for IO-Link data transmission. For details, see. "3.2 Terminal Definition" on page 28			
③	I/O indicator	1 to 16	I/O signal indicator	Green	- Steady on: State 1 - Off: State 0
④	I/O terminal	I/O	16 configurable terminals		

No.	Name	Description			
⑤	24V terminal	24V+	24 VDC power supply +	-	-
⑥	Grounding terminal	• GND (gray) • PE (orange)	-	-	-

Note

- Single flashing: 200 ms ON followed by 1000 ms OFF, repeating periodically.
- Flashing: 200 ms ON followed by 200 ms OFF, repeating periodically.
- Slow flashing: 900 ms ON followed by 100 ms OFF, repeating periodically.

1.3 Technical Specifications

■ General Specifications

Item	Specification
IP rating	IP20
Dimensions (W x H x D)	150 mm x 60 mm x 29 mm
Weight (g)	152 g

■ Power supply specifications

Item	Specification
Rated voltage of US power supply	24 VDC (18 VDC to 30.2 VDC)
Maximum current of US power supply	2 A (max@24 V)
US reverse polarity protection	Supported
Undervoltage detection	Supported

Item	Specification
Rated voltage of UA power supply	24 VDC (18 VDC to 30.2 VDC, common ground with US)
Maximum current of UA power supply	2 A (max@24 V)
UA reverse polarity protection	Supported
Undervoltage detection	Supported

■ Input specifications

Item	Specification
Input type	Digital input
Input mode	NPN
Maximum number of input channels	16
Input voltage class	24 VDC (18 VDC to 30.2 VDC)
Input current (typical)	4 mA (typical@24 V)
ON voltage	>15 VDC
OFF voltage	<5 VDC
Hardware response time ON/OFF	100 μ s/100 μ s
Input impedance	6.6 k Ω to 7.6 k Ω
Isolation	Not supported
Input action display	When the input is in the driving state, the input indicator becomes on.

■ Output specifications

Item	Specification
Output type	Digital output, transistor output
Output mode	NPN
Maximum number of output channels	16

Item	Specification
Output voltage class	24 VDC (18 VDC to 30.2 VDC)
Output load (resistive load)	0.5 A/channel; 2 A/module
Output load (inductive load)	7.2 W/channel; 12 W/module
Output load (lamp load)	5 W/channel; 9 W/module
Hardware response time ON/OFF	100 μ s/100 μ s
Leakage current at OFF	10 μ A
Switching frequency	100 Hz for resistive load; 0.5 Hz for inductive load; 10 Hz for lamp load
Isolation	Not supported
Output action display	When the output is in the driving state, the output indicator becomes off.

■ Software specifications

Item	Specification
Input/output configuration	The I/O channel of the module can be configured as input or output based on the actual application.
Output state mode during fault stop	Output zero, output last value, output preset value
Output preset value during fault stop	0 or 1
State inversion	The I/O channel state of the module can be inverted based on the actual I/O channel state. For example, assume that the external input is 0x00. When the state inversion function is disabled, the input process data is 0x00. When the state inversion function is enabled, the input process data is 0xFF.
Output readback	When the module is used for output, the output status is fed back to the master through aperiodic data.

Item	Specification
Undervoltage detection	When the voltage of the actuator power supply or system power supply is below 18 V, the status is fed back to the master through aperiodic data. The actuator power supply state is displayed by bits 2 and 3, and the system power supply state is displayed by bits 0 and 1.
Module type and basic information reading	When the master communicates with the slave normally, the master can read the basic information of the slave through the index. The basic information includes the Vendor ID, Device ID, Vendor name, Vendor text, Product name, Product ID, Hardware Revision, and Firmware Revision.
Mode configuration	The module supports dual operating modes configurable via parameter 0x49: Simple mode and Expert mode. Simple mode: Parameter configurations are not required and the parameter configuration function is invalid. All I/O channels can be used as inputs or outputs. Expert mode: All parameters can be configured. By default, 16 inputs are configured. The I/O channels can be quickly configured as 8 inputs and 8 outputs or 16 outputs.
Diagnostic information acquisition (application layer)	Errors, alarms, and maintenance data are obtained through events and are sent from the slave to the master.
Diagnostic information acquisition (link layer)	The diagnostic information is acquired through aperiodic data.

1.4 Environmental Specifications

Item	Operating Specification	Transportation Specification	Storage Specification
IP rating	IP20 (without dust cover) IP5X (with dust cover)		
Pollution degree	2		
Overvoltage category	II		
Temperature	-20°C to +55°C	-40°C to +70°C	-25°C to +70°C

Item		Operating Specification	Transportation Specification	Storage Specification
Humidity		10% to 95% RH, without condensation		
Vi- bra- tion	Frequen- cy	5 Hz to 200 Hz	2M2	1M2
	Displace- ment	3.5 mm (direct installation) (< 9 Hz)		
	Accelera- tion	1 g (direct installation) (> 9 Hz)		
	Direction	3-axial directions		
Shock (collision)		15 g, 11 ms, half sine wave, 3-axial directions		
Altitude/Air pressure		0 m to 2000 m	0 m to 3000 m (> 70kPa)	

2 Mechanical Installation

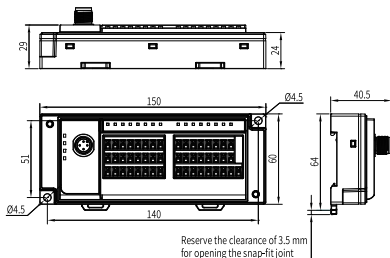
2.1 Installation Precautions

- Make sure the module is powered off before installing or removing.
- Do not hot swap the modules. Otherwise, the modules may be damaged by overcurrent or overvoltage, and the communication interface module or PLC may be subject to restart, user data loss or corruption.
- Do not drop or shock the housing or terminals of the module to avoid damage.

2.2 Installation Dimensions

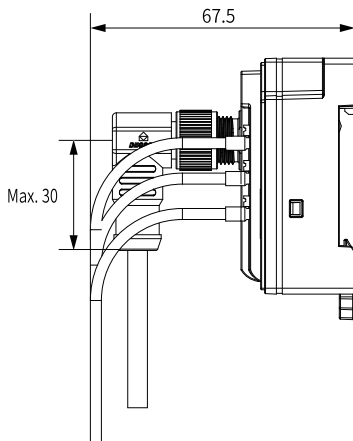
■ Module

The reference dimensions for module installation are as shown in the figure below (unit: mm).



■ Cable connection

The reference dimensions for connecting the M12A four-conductor cable with the female 90 degree angle connector are as shown in the figure below (unit: mm).



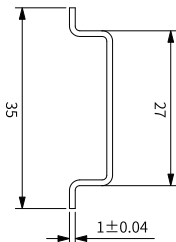
2.3 Module Installation

■ Installing the module

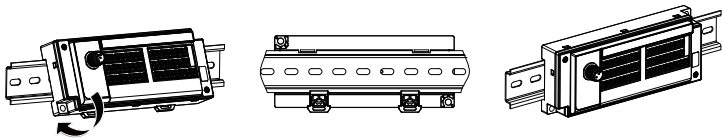
The module supports DIN rail-based installation and screw-based installation.

● DIN rail-based installation

The DIN rail must comply with IEC 60715 (width: 35 mm, thickness: 1 mm). The dimensions (unit: mm) are as shown in the figure below.

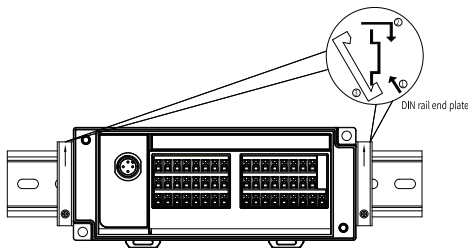


Hang the slot at the top of the module on the DIN rail and rotate the module backward until you hear a click, as shown in the figure below.



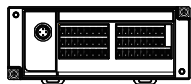
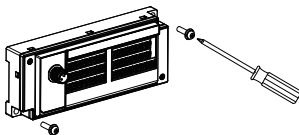
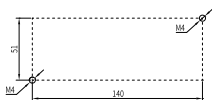
Note: After the module is installed, the DIN rail snap-fit joint will automatically move upwards to lock the module to the rail. If the snap-fit joint does not move upwards, press the top of the snap-fit joint upwards to lock the module.

Mount a DIN rail end plate on both ends of the module. To mount the DIN rail end plate, hook the bottom of it to the bottom of the DIN rail, rotate the end plate to hook the top of the end plate to the top of the DIN rail, and then tighten the screw to lock the end plate in place, as shown in the figure below.



● Screw-based installation

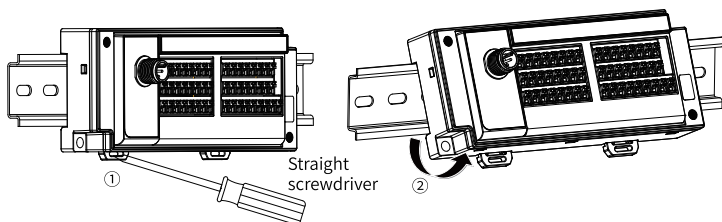
Screws and washers (optional) specifications: M4 screw length: ≥ 14 mm; washer diameter: ≤ 9 mm. Screw mounting hole specifications: 140 mm x 51 mm diagonal holes. See the following mounting hole dimensions and mounting diagram.



■ Removing the module

● DIN rail-based removal

Pry the DIN rail snap-fit joint downwards with a tool such as a slotted screwdriver, and then rotate the module outward to remove it, as shown in the figure below.



- **Screw-based removal**

Remove the M4 screws using a screwdriver, and then detach the module.

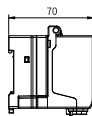
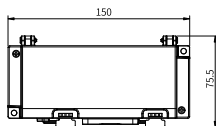
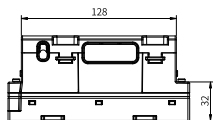
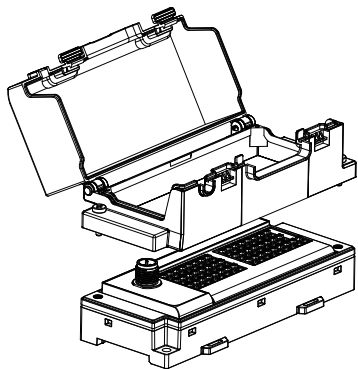
2.4 Dust Cover Installation (Optional)

The GR20-FCZ series dust cover is available. The order data is shown in the following table.

Model	Description	Product Code
GR20-FCZ	GR20-FCZ series dust cover	01480038

The dust cover is designed to prevent dust, splashing, and impact. It is made of transparent PC, which allows you to observe the running state of the module at any time. It is suitable for non-standard equipment and intelligent production lines.

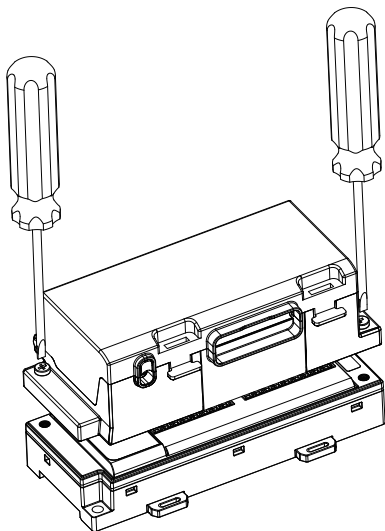
Install the dust cover on the module. Cabling space for IO-Link and input/output cables is reserved on the dust cover, allowing you to open/close the dust cover without tools and to maintain the module without removing the dust cover. The following figure shows the product diagram and dimensions.



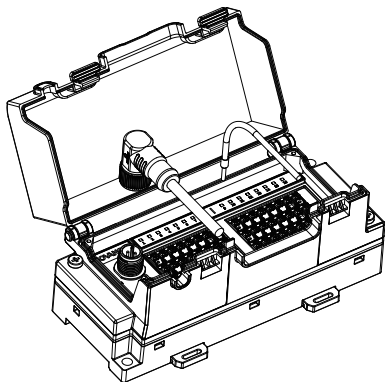
The dust cover is equipped with two captive screws. It supports two installation modes: installation before wiring and installation after wiring.

■ Installation before wiring

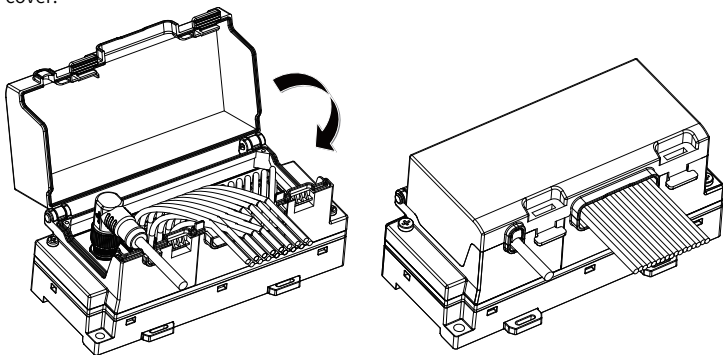
1. Align the screws with the screw holes on the module and tighten the screws to specified torque (5 kgf·cm) via a Phillips screwdriver.



2. Connect the IO-Link communication, I/O, 24 V power supply+, and grounding cables.

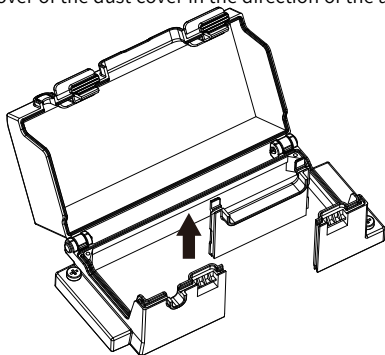


3. Rotate the upper cover of the dust cover in the direction of the arrow and lock the cover.

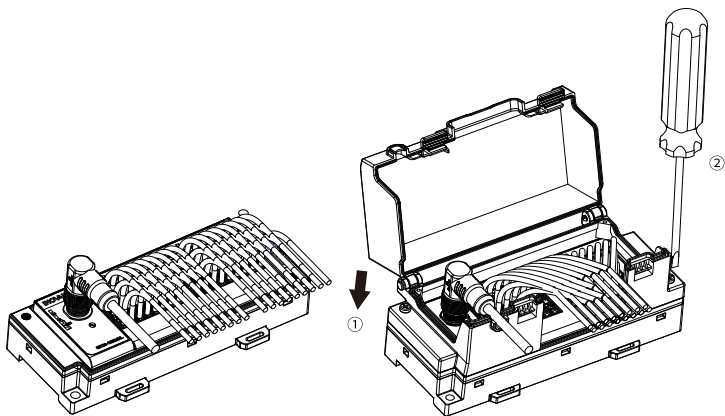


■ Installation after wiring

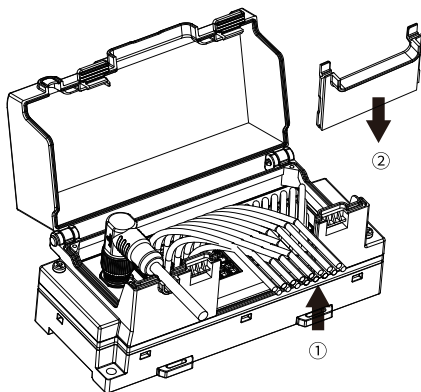
1. Take out the side cover of the dust cover in the direction of the arrow.



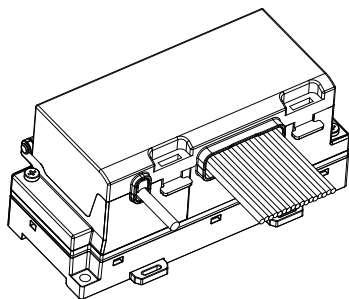
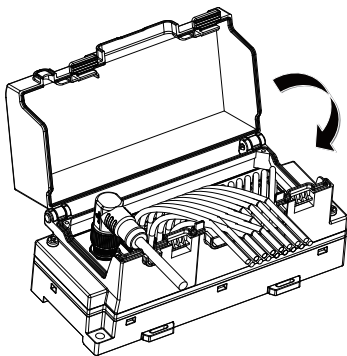
2. Route the I/O signal cables and communication cable through the opening of the side cover, install and secure the dust cover onto the module, then align the two screws with the screw holes on the module and tighten the screws to specified torque (5 kgf·cm) via a Phillips screwdriver.



3. Lift up the I/O, 24 V power supply +, and grounding cables from the opening of the dust cover, insert the side cover back to the dust cover, and then route the cables through the cable slot of the side cover.

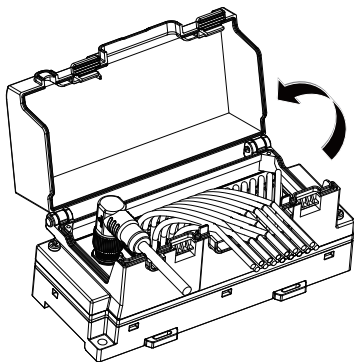
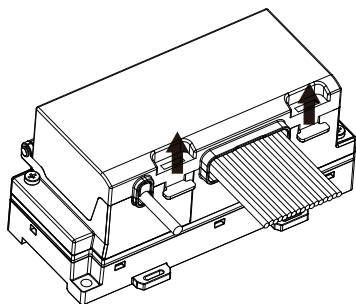


4. Rotate the upper cover of the dust cover in the direction of the arrow and lock the cover.



■ **Maintaining the cable**

To maintain the cable, lift up the two snap-fit joints and open the upper cover of the dust cover.



3 Electrical Installation

3.1 Cable Selection

■ IO-Link cable

The M12A four-conductor cable with the female 90 degree angle connector is used, as described below.

Model	Description	Material Code
PM-M12A-04P-FR-ML-8A03-00A(H)	Cable assembly - IO-Link cable - Male straight connector - 3 m-22AWG - Black - Female 90 degree angle connector - 85°C	15310142

Note

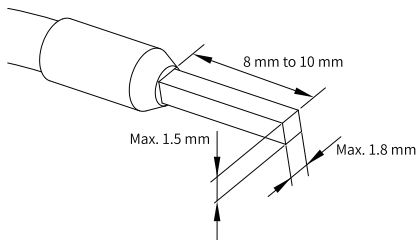
If you have additional requirements for IO-Link cables, contact Inovance for customization.

■ IO/24 V power supply +/-grounding cable

The cable lug and cable diameter included in the following table are only for reference.

Material Name	Applicable Cable Diameter		KST		Suzhou Yuanli	
	mm ²	AWG	Model	Crimping Tool	Model	Crimping Tool
Tubular lug	0.3	22	E0308	KST2000L	0308	YAC-5
	0.5	20	E0508		0508	
	0.75	18	E7508		7508	
	1.0	18	E1008		1008	

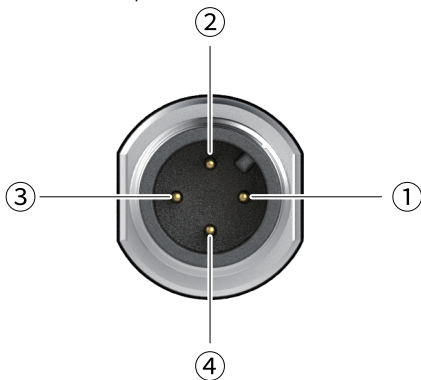
If you use other types of tubular lug, crimp the lug to the cables according to the shape and dimension requirements shown in the figure below.



3.2 Terminal Definition

■ IO-Link port pins

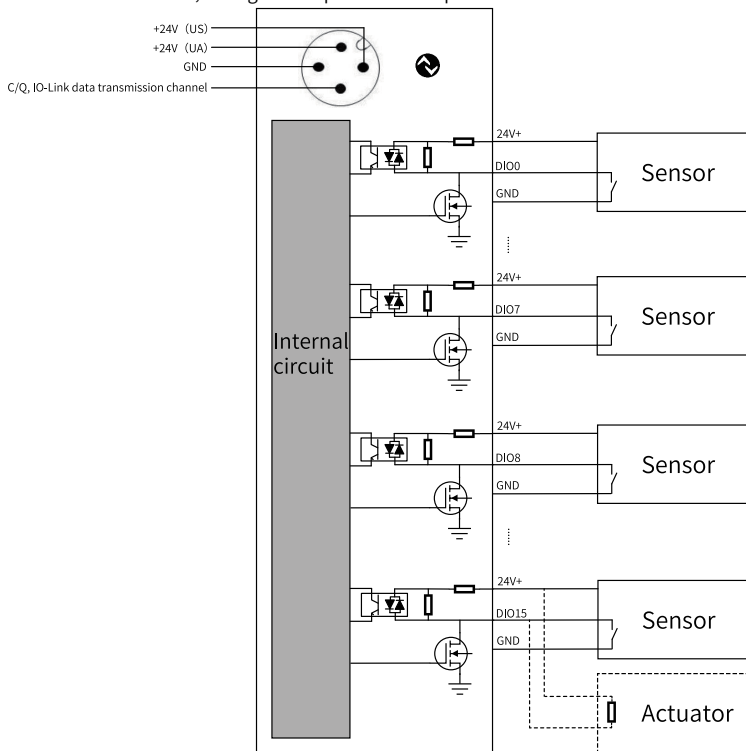
The IO-Link port is an M12A male port. The following figure describes pin numbers and the following table describes pins in details.



Pin No.	Pin Signal
①	US system and sensor power supply, +24V
②	UA actuator power supply, +24V
③	GND
④	C/Q, IO-Link data transmission

3.3 Terminal Wiring

When the sensor is connected, configure the port as an input channel. When the actuator is connected, configure the port as an output channel.



4 Program Commissioning

The configuration and commissioning are described when the module is used together with the GS20-ECT-8L high-protection IO-Link master module and the medium-sized PLC of Inovance. For details, see the "Configuration and Commissioning" section in the "GS20-ECT-8L High Protection IO-Link Master Module User Guide".

5 Troubleshooting

The following table lists the fault codes and their definitions.

Fault Code	Type	Name	Solution
0x4210	Warning	Overtemperature	The ambient temperature is high. Lower down the temperature before using the module.
0x4220	Warning	Low temperature	The ambient environment is low. Increase the temperature before using the module.
0x5011	Error	Loss of retentive data upon power failure	Retention of configuration parameters fails. Re-configure the parameter.
0x5100	Error	Device power supply error	The UA power supply of the module fails. Enable the power supply to pin 2 on the master or use the external UA power supply.
0x5110	Warning	System power supply overvoltage	The US power supply voltage of the module is higher than the normal operating voltage. Reduce the US power supply voltage.
0x5111	Warning	System power supply undervoltage	The US power supply voltage of the module is lower than the normal operating voltage. Increase the US power supply voltage.
0x7710	Error	Short circuit	The module encounters short circuit. Check the external wiring.
0x6320	Error	Parameter error	The module parameters are configured incorrectly. Configure the parameters correctly according to the product data.
0x6321	Error	Parameter loss	In expert mode, an input signal is detected for a channel configured as output. Modify the input/output configuration parameter 0x41 according to actual usage.

6 Object List

6.1 Protocol Stack Data

Baud rate	COM2 (38.4 Kbaud)
Minimum cycle time	3 ms
IO-Link version	1.1.3
Minimum Cycle Time for Process Data	3 ms
Vendor ID	0x0659
Device ID	-

6.2 Process Data

Input data	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15	DIO14	DIO13	DIO12	DIO11	DIO10	DIO9	DIO8
-	Input data refers to the data sent from the slave to the master.								

Output data	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15	DIO14	DIO13	DIO12	DIO11	DIO10	DIO9	DIO8
-	Output data refers to the data sent by the master to the slave.								

6.3 Product Data

In- dex	Sub- in- dex	Object	Length	Range	Default Value
0x07	-	Vendor ID	2 bytes	-	0x0659
0x08	-	Device ID	2 bytes		0xF42D10
0x10	0	Vendor name	8 bytes		INOVANCE
0x11	-	Vendor text	16 bytes		www.inovance.com
0x12	-	Product name	21 bytes		GR20-16EMNL
0x13	-	Product ID	7 bytes		01440355
0x14	-	Product text	23 bytes		GL20-16DIO:IO Sensor/Actuator Hub IP20 16Bit
0x16	-	Hardware revision	4 bytes		1.0.0.0
0x17	-	Firmware revision	4 bytes		1.0.0.0
0x40	0	Inversion	2 bytes	0x0000-0xFFFF	0x0000
0x41	0	Configuration Input/Output	2 bytes	0x0000-0xFFFF	0x0000
0x42	0	DIO0-DO07 Safe State	2 bytes	0x0000-0xFFFF	0x0000
0x43	0	DIO8-DIO15 Safe State	2 bytes	0x0000-0xFFFF	0x0000
0x44	0	Under Voltage	2 bytes	0x0000-0xFFFF	0x0000
0x47	0	Feedback	2 bytes	0x0000-0xFFFF	0x00000000
0x48	0	Temperature detection	2 bytes	0x0000-0xFFFF	0x0000

Input data	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15	DIO14	DIO13	DIO12	DIO11	DIO10	DIO9	DIO8

Output data	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15	DIO14	DIO13	DIO12	DIO11	DIO10	DIO9	DIO8

0x40: State inversion (R/W)	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
	Default	0	0	0	0	0	0	0	0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15	DIO14	DIO13	DIO12	DIO11	DIO10	DIO9	DIO8
	Default	0	0	0	0	0	0	0	0
	0 = Disable inversion; 1 = Enable inversion								

0x41: Input and output configuration (R/W)	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
	Default	0	0	0	0	0	0	0	0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15	DIO14	DIO13	DIO12	DIO11	DIO10	DIO9	DIO8
	Default	0	0	0	0	0	0	0	0
	0: Input; 1: Output								

0x42: Action of DIO0 to DIO7 (R/ W) when a fault occurs	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO3		DIO2		DIO1		DIO0	
	Subin- dex	4		3		2		1	
	Default	00		00		00		00	
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7		DIO6		DIO5		DIO4	
	Subin- dex	8		7		6		5	
	Default	00		00		00		00	
	00: Low level; 01: High level; 10: Last state; 11: Reserved								

0x43: Action of DIO8 to DIO15 (R/ W) when a fault occurs	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO11		DIO10		DIO9		DIO8	
	Subin- dex	4		3		2		1	
	Default	00		00		00		00	
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15		DIO14		DIO13		DIO12	
	Subin- dex	8		7		6		5	
	Default	00		00		00		00	
	00: Low level; 01: High level; 10: Last state; 11: Reserved								

0x44: System monitoring (R)	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	-	-	-	-	-	-	-	T
	Default	-	-	-	-	-	-	-	0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	-	-	-	-	UA		US	
	Default	-	-	-	-	0	0	0	0
	US: System power supply voltage. 00: Normal; 01: Below 18 V; 10: Above 30.2 VDC; 11: Reserved.								
	UA: Actuator power supply voltage. 00: Normal; 01: Below 18 V; 10: Above 30.2 VDC; 11: Reserved.								
	T: MCU temperature. 0: MCU temperature below setpoint; 1: MCU temperature above setpoint.								
	-: Not in use								

0x47: Output state readback (R)	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
	Sub-index	8	7	6	5	4	3	2	1
	Default	0	0	0	0	0	0	0	0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	DIO15	DIO14	DIO13	DIO12	DIO11	DIO10	DIO9	DIO8
	Sub-index	16	15	14	13	12	11	10	9
	Default	0	0	0	0	0	0	0	0
	0: 0 is output; 1: 1 is output.								

0x48: MCU temperature setting (R/W)	Byte	0	1
	Default	80	
	Unit	°C	

0x49: Mode configuration (R/W)	Byte	0							
	Bit	7	6	5	4	3	2	1	0
	Pin	-	-	-	-	-	0016	0808	Mode configuration
	Default	-	-	-	-	-	0	0	0
	Byte	1							
	Bit	7	6	5	4	3	2	1	0
	Pin	-	-	-	-	-	-	-	-
	Default	-	-	-	-	-	-	-	-
	Mode configuration: 0 = Simple mode; 1 = Expert mode For pin 0808, 0 indicates quick configuration is disabled; 1 indicates quick configuration as 8 outputs and 8 inputs. This feature is valid only in expert mode. Pins 1 to 8 are set to the input mode, and Pins 9 to 16 are set to the output mode. When pin 0808 is configured, the configuration parameter 0x41 becomes invalid. For pin 0016, 0 indicates quick configuration is disabled; 1 indicates quick configuration as 16 outputs. This feature is valid only in expert mode. Pins 1 to 16 are set to the output mode. When pin 0016 is configured, the configuration parameter 0x41 becomes invalid. Note In the simple mode, configuration parameters 0x41 to 0x43 are unavailable. In the expert mode, all configuration parameters are available. If the configured values are not set according to the preceding descriptions, a 0x6320 parameter error is reported, and the system will execute using the last correctly configured parameters.								

7 Appendix: Version Information

You can get the firmware of the module and the firmware of communication interface module from Inovance technical support, and get InoProShop from <https://www.inovance.com>. The following table describes the version matching information.

Module Firmware Version	InoProShop Version
1.3.0.0	V1.7.3 SP2 and later